Set 1: Cartesian Coordinates & Distance Formula

Easy

1. **Q:** Plot the points $(2, 3)$ and $(5, 7)$ on the Cartesian plane.
   A: Plot both points on graph paper or using a plotting tool.
2. **Q:** Identify the quadrant for the point $(-4, 6)$.
   A: Second quadrant.

Medium

3. **Q:** Find the distance between $(1, 2)$ and $(4, 6)$.
A:
$d = \sqrt{(4-1)^2 + (6-2)^2} = \sqrt{25} = 5$

4. **Q:** Calculate the midpoint between $(-3, 5)$ and $(3, -1)$.
   A:
   $M = ((-3+3)/2,\ (5+(-1))/2) = (0,\ 2)$
5. **Q:** A square has corners at $(1, 1)$ and $(5, 1)$. Find the length of one side.
   A:
   $d = \sqrt{(5-1)^2} = 4$
6. **Q:** Determine if triangle with points A$(0, 0)$, B$(3, 4)$, C$(3, 0)$ is right-angled.
   A:
   AB = 5, BC = 4, AC = 3.
   $3^2 + 4^2 = 5^2$, so it's right-angled.

Hard

7. **Q:** A circle has diameter endpoints at $(-2, 4)$ and $(6, 8)$. Find the center and radius.
A:
Center = midpoint = $(2, 6)$;
Radius = $\sqrt{(6-2)^2 + (8-4)^2}/2 = \sqrt{80}/2 \approx 4.47$

8. **Q:** Two machines are located at A$(2, 3)$ and B$(10, 15)$. Calculate the exact distance and suggest the shortest cable route.
   A:
   Distance = $\sqrt{(10-2)^2 + (15-3)^2} = \sqrt{208} \approx 14.42$ m
   Suggest a direct cable route.

Applications

9. **Q:** In a factory layout, determine the distance between loading dock at $(1, 2)$ and storage point at $(7, 10)$.
A:
$d = \sqrt{(6)^2 + (8)^2} = \sqrt{100} = 10$

10. **Q:** A robot starts at $(0, 0)$ and moves to $(3, 4)$. What is the shortest path traveled?
    A:
    $d = 5$ (3-4-5 triangle)

Set 2: Equation of a Straight Line

Easy

1. **Q:** Write the equation with slope 2 and y-intercept 5.

   A:

   $y = 2x + 5$

2. **Q:** Write the line equation passing through (3, 4) with slope –1.

   A:

   $y - 4 = -1(x - 3) \Rightarrow y = -x + 7$

Medium

3. **Q:** Find the slope of the line passing through (1, 2) and (5, 6).

A:

$m = (6 - 2)/(5 - 1) = 1$

4. **Q:** Find the equation of the line passing through (2, 3) and (6, 11).

   A:

   Slope = 2;

   $y - 3 = 2(x - 2) \Rightarrow y = 2x - 1$

5. **Q:** Determine the x- and y-intercepts of the line $y = 3x - 6$.

   A:

   x-int = 2; y-int = –6

6. **Q:** Convert $y - 2 = 4(x + 1)$ into slope-intercept form.

   A:

   $y = 4x + 6$

Hard

7. **Q:** Find the equation of a line through (–2, 3) perpendicular to $y = 2x + 1$.

A:

Perpendicular slope = –½;

$y - 3 = -½(x + 2) \Rightarrow y = -½x + 2$

8. **Q:** Write the equation of a line with x-intercept 4 and y-intercept 3 (intercept form).

   A:

   $x/4 + y/3 = 1$

Applications

9. **Q:** In CAD, a line connects (0, 0) and (4, 6). What's the equation?

A:

Slope = 1.5; Equation: $y = 1.5x$

10. **Q:** An engineer designs a ramp from (0, 0) to (5, 1). Find the slope and equation.

    A:

    Slope = 0.2; Equation: $y = 0.2x$

Set 3: Parallel and Perpendicular Lines

Easy

1. **Q:** Are $y = 2x + 3$ and $y = 2x - 1$ parallel?

   A:

   Yes, both have slope = 2

2. **Q:** Are $y = x$ and $y = -x$ perpendicular?

   A:

   Yes, slopes multiply to −1.

Medium

3. **Q:** Are lines $y = 0.5x + 1$ and $y = -2x + 4$ perpendicular?

A:

Yes, 0.5×(−2) = −1

4. **Q:** Find the slope of a line perpendicular to a line with slope 2/3.

   A:

   −3/2

5. **Q:** Find the line parallel to $y = -3x + 2$ passing through (1, 1).

   A:

   $y - 1 = -3(x - 1) \Rightarrow y = -3x + 4$

6. **Q:** Find the line perpendicular to $y = 4x - 5$ through (0, 0).

   A:

   Slope = −¼; Line: $y = -\frac{1}{4}x$

6. **Q:** Find the line perpendicular to $y = 4x - 5$ through (0, 0).

   A:

   Slope = −¼; Line: $y = -\frac{1}{4}x$

Hard

7. **Q:** Prove triangle A(0, 0), B(4, 0), C(4, 3) is right-angled.

A:

AB horizontal, BC vertical → right angle at B

8. **Q:** Find the line perpendicular to $y = 0.25x + 1$ through (−2, 4).

   A:

   Slope = −4;

   $y - 4 = -4(x + 2) \Rightarrow y = -4x - 4$

Applications

9. **Q:** In a mechanical drawing, if one edge has slope 2, what is slope of an edge perpendicular to it?

A:

−½

10. **Q:** A ventilation shaft is drawn perpendicular to the base line y=0. If it passes through (3, 0), what's the equation?

    A:

    Vertical line: $x = 3$

Set 4: Gradient & Angle Between Lines

Easy

1. **Q:** Gradient of line through $(1, 2)$ and $(4, 5)$?

   A:

   1

2. **Q:** Gradient of line $y = -3x + 2$?

   A:

   −3

Medium

3. **Q:** Gradient of line through $(2, 4)$ and $(6, 12)$?

A:

2

4. **Q:** Angle between lines with slopes 1 and −1?

   A:

   90° ($\tan\theta = \infty$)

5. **Q:** Angle between gradients 2 and −1?

   A:

   $\tan\theta = 3 \rightarrow \theta \approx 71.6°$

6. **Q:** Angle between lines $y = x$ and $y = 2x + 3$?

   A:

   $\tan\theta = 1/3 \rightarrow \theta \approx 18.4°$

Hard

7. **Q:** Two lines have slopes 5 and −0.2. What's the angle between them?

A:

90° ($\tan\theta = \infty$)

8. **Q:** Lines through origin: $(3, 4)$ and $(4, 3)$. Calculate their angle.

   A:

   $\tan\theta = 7/24 \rightarrow \theta \approx 16.3°$

Applications

9. **Q:** Ramp gradient is 0.5. What is its incline angle?

A:

$\theta \approx 26.6°$

10. **Q:** Two pipelines slope 1 and 3. Find their intersection angle.

    A:

    $\tan\theta = 0.5 \rightarrow \theta \approx 26.6°$